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**TEACHING AQUATIC ECOLOGY
WITHIN ECOSYSTEM AND MANAGEMENT CONTEXTS:
THE LAKE POWELL
COOPERATIVE EDUCATION PROGRAM**

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ABSTRACT: Resource managers are increasingly asked to work at the ecosystem level of organization and to use team approaches to address management problems. Here we describe a senior/graduate level course that helps students to understand the complexity of an ecosystem, and to begin working with a resource agency. We have collaborated with the Glen Canyon National Recreation Area (National Park Service) to find research problems that will help them manage the Lake Powell ecosystem. The Park Service receives useful research from the program, and they have partially underwritten the considerable cost of teaching the course. Projects undertaken have included studying the significance of the pelagic food web for endangered fishes, and the importance of production processes in the extensive side canyons of the reservoir.

At the beginning of the quarter, individual or pairs of students in the class choose subcomponents of the research question, then develop hypotheses by using the literature. The students, with the assistance of the instructors, write research proposals describing their hypotheses and methods for testing their hypotheses. Also included in the proposal is a section describing the student's role in the overall project. Usually the projects encompass topics ranging from physical limnology to fish ecology. The field work for the research is conducted on a 3-5 day field trip to Lake Powell where we work from a houseboat-laboratory and from axillary boats. For the remainder of the quarter, the students analyze the data as a class so that everyone learns the specific techniques. Students then process their data, integrate it with the data of others in the class, and prepare oral and written reports. The reports are edited, bound, and provided to resource agencies working at Lake Powell. Pedagogical benefits of the program for the students include: (1) students must integrate a project from conception through final report writing; (2) they must collaborate to be successful; and (3) diligence is encouraged because the students realize that their work may actually be used by agency personnel and other scientists.

EXPERIENCE AND EXPERIMENTS IN INTEGRATING ECOLOGY AND ENVIRONMENTAL POLICY IN AN UNDERGRADUATE CURRICULUM

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ABSTRACT: In 1986 the School of Natural Resources (SNR) embarked on a project to define and implement an undergraduate core curriculum that integrates natural and social science in the context of natural resource education. Currently this curriculum includes seven courses (21 credits) taken over five semesters beginning in the student's first semester and ending in their last year. At the outset, the students take two separate introductory courses, one introducing them to concepts in natural science and the other introducing them to natural resources from a social and cultural perspective. This paper describes the next phase of their curricular experience, a set of three courses taken concurrently. The overall goals of the courses are to introduce and integrate theories and approaches to analysis in ecology and social science as applied to environmental issues. This paper describes our use of the concept of integration in the context of natural resource education and three models for incorporating it into this portion of the SNR Core Curriculum. Our working definition of integration involves three levels: (1) process-logistics integration, (2) content integration, and (3) framework integration. The first is related to the process of establishing and delivering the courses including management of instructor, student, and teaching assistant roles across the disciplines. The second is related to bringing together ecological and social science knowledge to provide different views of a single natural resource case or issue. The third is related to recognizing and using conceptual frameworks shared across ecological and social science.

We used three different models to incorporate these levels of integration into the set of three courses. On one end of the spectrum, three instructors taught three distinct courses. One addressed ecology, a second one addressed social science, and a third linked the other two through the use of natural resource case studies. At the other end of the spectrum, two instructors (one ecology specialist, one public policy specialist) co-taught the courses. In this model, the classes were combined into a 7-credit block, and we taught in a collaborative learning and teaching environment using case studies and student-directed projects. The third model is intermediate. It included two primary instructors and a secondary instructor. The two primary instructors each taught a distinct course (one in ecology, the other in social science) while working together with the secondary instructor to create the third component. This third component provided a complementary set of case studies, exercises, and papers which supported student learning in the ecology and social science courses while requiring students to bring together material from both.

This paper discusses the three models and compares them based on the three levels of integration. The paper also assesses the implications of the course models relative to instructor and student effort and success in achieving content and framework integration. We conclude that no single approach is necessarily best, but rather, the three taken together represent a set of tradeoffs and different opportunities for instructor and student learning and effort. Development of this component of the SNR Core Curriculum continues to evolve. An important part of this evolution is a search for a working definition of integration appropriate to undergraduate natural resource education. In our view, it is important that this search continue to include interaction and debate among members of the entire SNR faculty.